



# Proposal for Bedford – Halifax Ferry & Prototype for Ridership Forecasting - *A Data Intensive Approach*

Team: ODS

# Necessity of Ferry Route from Bedford to Halifax

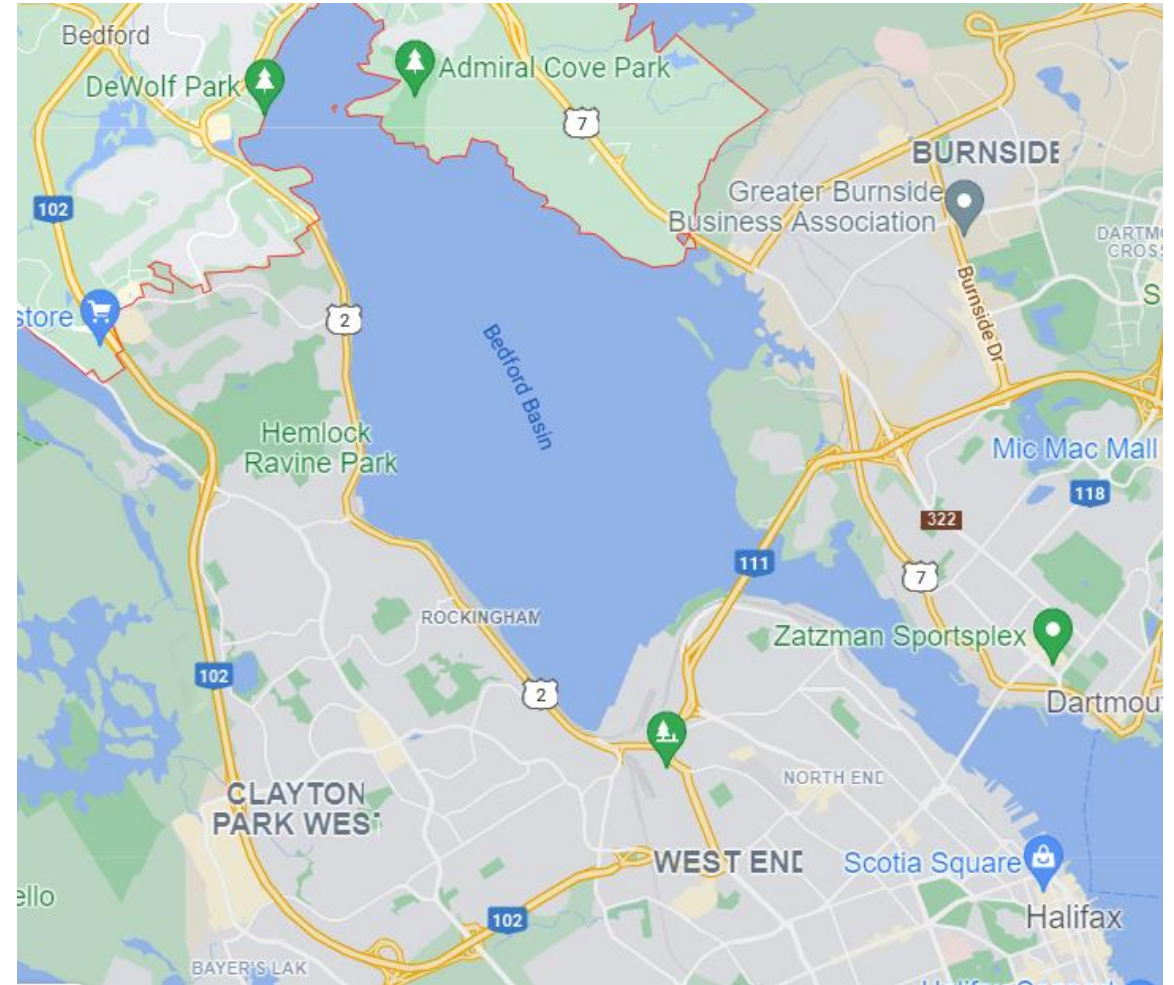
**Goal: Ease traffic volume of Highway 102**

**So, the questions are:**

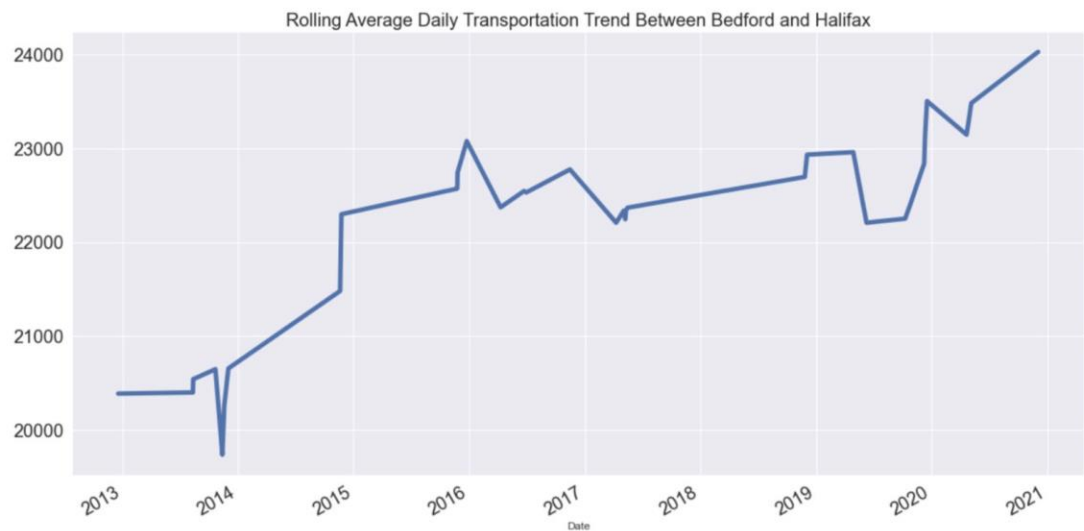
- Why should we do that?
- What happened to Highway 102?

**What should we do next:**

- Investigate Highway 102 traffic volume
- Discover patterns of Highway 111 and Ferry DH/HD to support a need for Bedford ferry

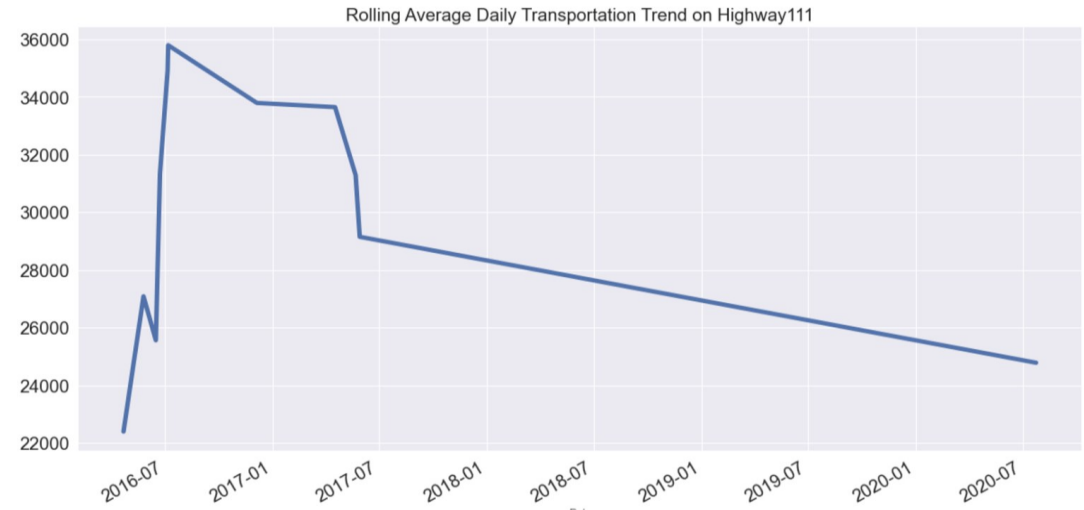


# Highway 102 Transportation Trend over Years



Highway 102 transportation volume increases over years, especially in recent 2 years. A need to reduce the heavy traffic

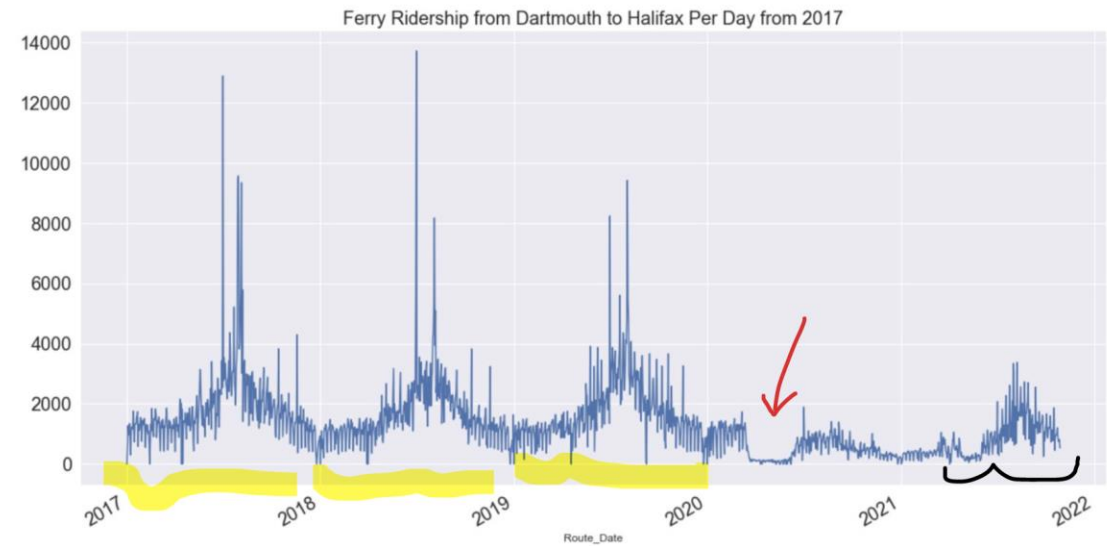
# Highway 111 Transportation Trend over Years



Highway 111 transportation volume maintains a stable trend over years

If... we had a Bedford Ferry

# Ferry (Dartmouth- Halifax) Daily Ridership

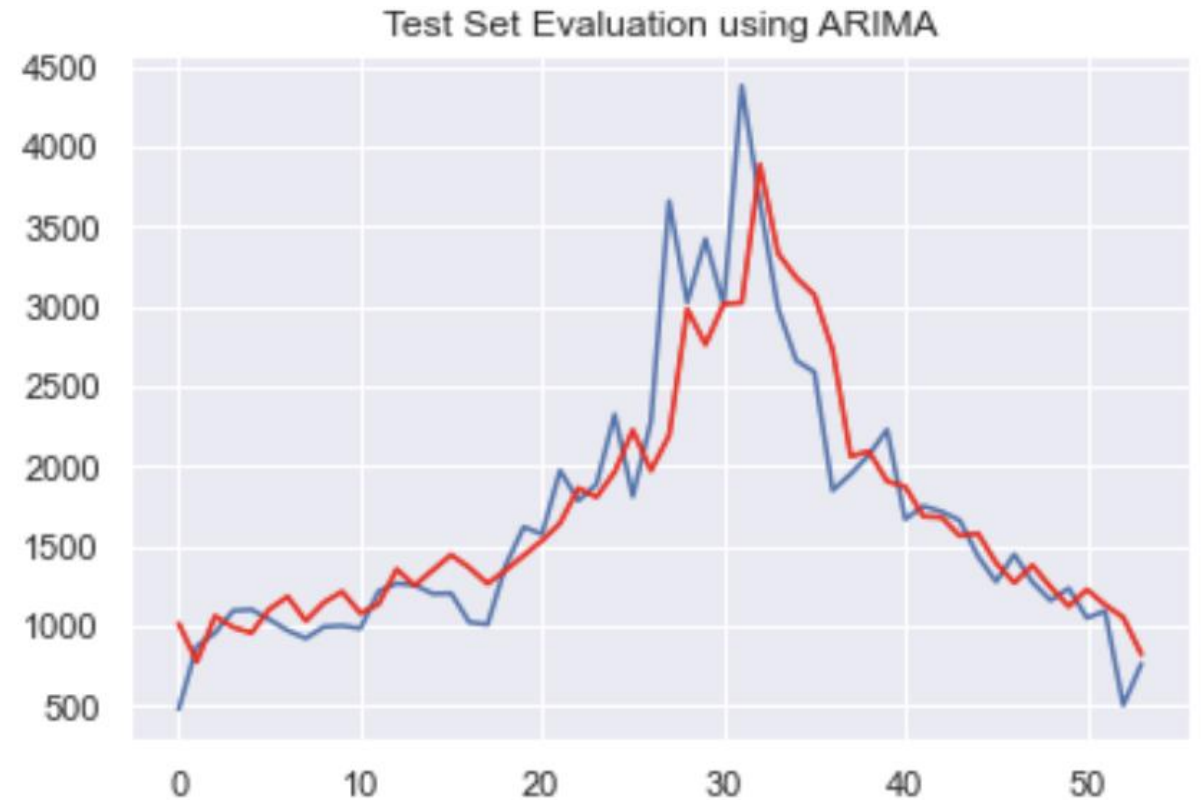
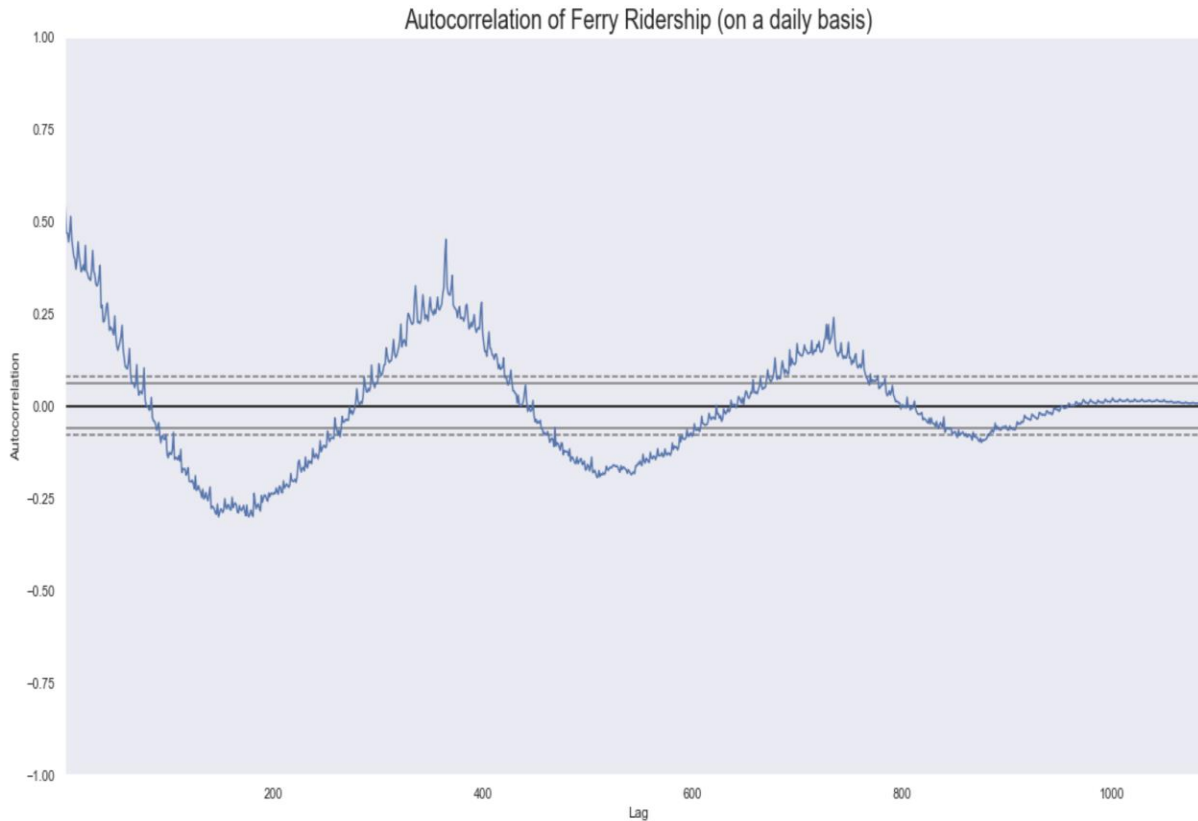


Seasonality existed during Pre-Covid times (Yellow) and after-Covid times (Black line)



# A Predictive Approach – ARIMA:

If we can predict the daily traffic volume of Ferry...

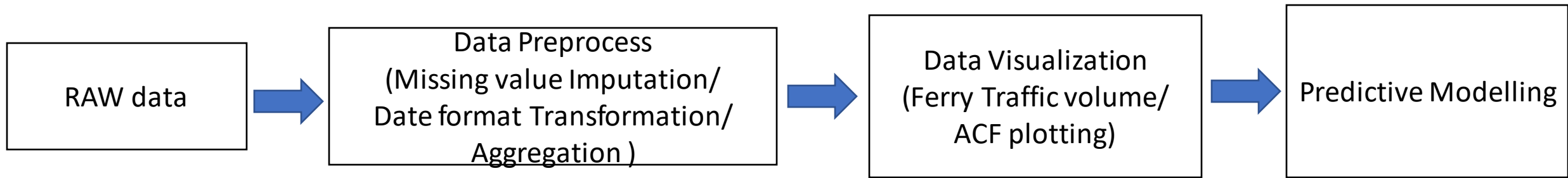


By plotting Autocorrelation function, seasonality of FerryDH exists! We proposed an **ARIMA** model after tuned the hyperparameters to predict future ferry traffic volume for Ferry DH/HD (either daily, weekly or even monthly).

If **Ferry Bedford – Halifax** opens in the future, similar approach could also be applied!

## A Prototype for Ferry Ridership Forecasting:

To automatically read data, preprocess, plot and predict traffic volume for ANY given time window for ANY ferry route by just input a raw data file



# Assumptions & Predictions

## Assumptions:

- The ratio of Dartmouth – Halifax/Woodside ferry rides to its alternative on-land route (HW\_111) traffic volume (**17%**) is the same for the Bedford – Halifax ferry rides to the alternative on-land route (HW\_102 Bedford –Halifax section) traffic volume.
- The Bedford – Halifax ferry runs every day of the year, except Christmas Day, New Year's Day, Good Friday, and Easter Sunday.
- The fare of the Bedford – Halifax ferry will be stable at **\$4** one way per person.
- The investment of Bedford – Halifax (Mill cove) route is **\$38.8** million which is accounted for 1/3 of the total investment of \$116.5 million.

## Predictions:

- The Bedford – Halifax ferry will ease off the daily traffic volume of HW102 (Bedford to Halifax section) by **14.5%**.
- Bedford – Halifax daily ferry rides will be ~**2848**.
- The annual revenue of Bedford – Halifax route will be around **\$4.1** million, which will be accounted for **10.5%** of the investment of the terminal.

Thank you.




# Data Source

- HRM Open Data. (2021). Transit Ferry Passenger Counts. Retrieved from: <https://catalogue-hrm.opendata.arcgis.com/datasets/780113e58f41464eba808a7ec20ba390/explore>
- Data Nova Scotia. (2021). Traffic Volumes – Provincial Highway System. Retrieved from: <https://data.novascotia.ca/Roads-Driving-and-Transport/Traffic-Volumes-Provincial-Highway-System/8524-ec3n>
- Halifax Regional Municipality. (2021). Transforming Transit. Retrieved from: <https://www.halifax.ca/transportation/transportation-projects/transforming-transit>



# Appendix 1: Current Ferry Average Daily Rides

Row Labels	 Average of Ridership_Total
Dartmouth to Halifax	1341
Halifax to Dartmouth	1354
Halifax to Woodside	891
Woodside to Halifax	867
<b>Average Daily Rides</b>	<b>1155</b>
<b>Total Daily Rides</b>	<b>4453</b>

# Appendix 2: HW\_111 Average Daily Traffic

• SECTION DESCRIPTION	
• EXIT 4 (HWY 118 INTER/C) TO EXIT 5 (MIC MAC BLVD)	43438
• EXIT 5 (MIC MAC BLVD) TO EXIT 6 (TK 7 MAIN ST, RTE 318)	40054
• EXIT 3 (BURNSIDE DR INTER/C) TO EXIT 4 (HWY 118 INTER/C)	33784
• EXIT 2 (VICTORIA RD INTER/C) TO EXIT 3 (BURNSIDE DR INTER/C)	31668
• EXIT 6 (TK 7 MAIN ST, RTE 318) TO EXIT 7 (RTE 207 PORTLAND ST)	22574
• EXIT 7 (RTE 207 PORTLAND ST) TO EXIT 8 (MOUNT HOPE AVE)	12742
• EXIT 8 (MOUNT HOPE AVE) TO EXIT 9 (PLEASANT ST INTER/S)	11851
• Total Average	25826

# Appendix 3: HW\_102 Average Daily Traffic (from Bedford to Halifax)

• SECTION DESCRIPTION	
• EXIT 1 (NORTH WEST ARM DR INTER/C) TO EXIT 1A (HWY 103 INTER/C)	24062
• EXIT 2A (BAYER'S LAKE INTER/C) TO EXIT 2 (KEARNEY LAKE INTER/C)	20793
• EXIT 1A (HWY 103 INTER/C) TO EXIT 2A (BAYER'S LAKE INTER/C)	20212
• EXIT 3 (RTE 213 INTER/C) TO EXIT 4 (HWY 101 INTER/C)	19586
• EXIT 2 (KEARNEY LAKE RD INTER/C) TO EXIT 2B (LARRY UTECK BLVD)	18870
• EXIT 2B (LARRY UTECK BLVD) TO EXIT 3 (RTE 213 INTER/C)	17112
• JOSEPH HOWE DR TO EXIT 1 (NORTH WEST ARM DR INTER/C)	10416
• Total Average	19603

# Appendix 4: Predicted Daily Rides from Bedford to Halifax

Ferry/On-Land Traffic Ratio		17%
	Transpotation	Average Daily Volumn
Halifax - Dartmouth/ Woodside	Ferry	4453
	On-Land	25826
Bedford - Halifax	Ferry	2848 *
	On-Land	19603
* Predicted volumn using $2848/(19603-2848) = 17\%$		

# Appendix 5: Total Investment of New Routes

New ferry service timeline and investment		
Investment	Amount	Timeline
Procurement of vessels (10)	\$71M	Years 1-4
Halifax Ferry Terminal upgrade	\$17M	Years 1-3
Mill Cove Terminal	\$6M to \$18M	Years 1-3
Larry Uteck Terminal	\$6M to \$7M	Years 1-4
Shannon Park Terminal	\$4M to \$8M	Aligned with development
Additional studies, functional plans and project overhead	\$4M	Year 1 onward
Total	\$108M to \$125M	4+ years

Source: [www.halifax.ca/transportation/transportation-projects/transforming-transit](http://www.halifax.ca/transportation/transportation-projects/transforming-transit)